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ABSTRACT

The recent concern with industrial achievement has reinforced a growing tendency to be concerned with educational achievement. This study, the first in a series, examined whether or not student motivation made a unique contribution to achievement that could be separated from other factors known or thought to contribute to student achievement such as various characteristics of the school. This study used data gathered by the Illinois State Board of Education and the University of Illinois in 1970 and 1981. High school juniors attending 120 schools were the subjects; the 1981 sample consisted of 9,693 students. Academic achievement, school context, family context, and student motivation were measured. Results suggest that variables composing the school context measure were least predictive of achievement variance and student motivation was the most predictive. Overall the expectation variable was the most predictive across all achievement domains. Family context cluster variables were important to school achievement across all subject areas. The results of this research illustrate the vital and critical role played by motivation in determining school achievement. (ABL)

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Sources of Student Achievement:

Student Motivation, School Context and Family Background

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Running Head: Sources of Student Achievement

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The recent concern with industrial achievement (Lawler, 1986; Ouchi, 1981; Peters & Austin, 1985; Peters & Waterman, 1982) has reinforced a growing tendency to be concerned with educational achievement. Indeed, one could even suggest that increasingly, the schools and education are seen as the central force in reforming other societal organizations, thus enhancing societal productivity (Maehr & Archer, 1987). Therewith, a large body of research concerned with educational productivity (Uguroglu & Walberg, 1979; Walberg, 1980, 1984; Walberg, Pascarella, Haertel, Junker, & Boulanger, 1982, Walberg & Uguroglu, 1980), and school effectiveness (Good & Weinstein, 1986; Purkey & Smith, 1982) has emerged. While attempting to varying degree to hold ability constant, this research has focused especially on factors such as family background and school characteristics but rarely on the unique contribution of student motivation.

This article is the first in what will be an integrated series of reports on school motivation and achievement. The broader purpose of this series of studies is to determine the role and contribution of motivation in the determination of achievement in different subject matter areas at different stages or grade levels. The primary purpose of this first study is to determine whether or not student motivation makes a unique contribution to achievement that can be separated from other factors known or thought to contribute to student achievement such as various characteristics of the school. Thus, we compare

the possible motivation effects with other possible antecedents to assess the importance of motivation in relationship to other factors. A wide variety of school characteristics, family backgrounds, and motivational variables are examined in relationship to student achievement in a wide variety of academic areas. A summary of the variables considered is presented in Table 1.

Insert Table 1 about here

The data that formed the basis for this study were gathered by the Illinois State Board of Education (ISBE) as part of the so-called "decade study" (Fyans & Stenzel, 1981). The decade study provides a unique opportunity to consider three sources of student achievement in relationship to each other: family background, school context, and student motivation. Moreover, it provided an opportunity to study these variables in the case of two large representative samples gathered at two different points in time (1970 and 1981). Our goal was to distinguish the degree to which achievement variance in six different academic areas could be uniquely attributed to motivation or the other two antecedent areas. While it is often said that student motivation is critical to school achievement, this assertion is seldom formally tested. And, the degree of importance of motivation is almost never quantified. A notable exception here is to be found in Walberg's work (Ugurgolu & Walberg, 1979; Walberg, et al.,

1983; Walberg & Ugurgolu, 1980). Yet, Walberg's work suffers from the fact that the motivational variables employed are not truly representative of the constructs and measures which are given wide usage in current motivation theory and research. Thus, it is the aim of this study to put the role of motivation in context to some degree. To what extent does it serve to explain school achievement when compared with other factors of assumed importance? If individual student motivation is found to play an important and unique role, this may well have important implications on how one chooses to approach questions of educational achievement, productivity, and school effectiveness. Of course, we do not pretend that this study will answer all questions in this regard. Rather, it serves as a first stage in a program of research that may serve as a step along the way to putting motivation in context.

Method

Samples and Subjects

This study is based on data gathered by the University of Illinois and the Illinois State Board of Education in 1970 and 1981. It involves two large representative samples of high school juniors who were at attendance at the same 120 selected schools at those two different time periods. More specifically, data were collected from 9,693 students who were juniors in high schools in Illinois in 1981. 120 Illinois high schools were selected at random from throughout the state, with the sampling

strategy aimed at deriving a sample of Illinois schools similar to the Illinois schools which participated in an assessment in 1970. All of the schools participating in 1981 had participated in 1970. While the focus of this study will be on the more recent and complete data gathered in 1980, we also attend to possible replication of results found in the 1970 sample. Characteristics of the 120 school sample in 1981 and the schools are summarized in Table 2. It will be noted there that the 120 schools sampled in 1980 were arguably similar in characteristics to those sampled in 1970. It may be noted, however, that overall there was a definite change in per student expenditures and a lower teacher/student ratio in 1980. While this factor should be taken account of in any comparison of results in the case of the two samples, it may be noted that it is representative of trends present throughout the state--and to varying degrees across the country.

Insert Table 2 about here

Achievement. Six tests of academic achievement were used in this study: Natural Science, Social Science, English Part I, English Part II, Mathematics Part I, and Mathematics Part II.

Both English subtests tapped editing of English. However, items of English I focused on grammar, usage, word choice, and idiom. The item consisted of presenting a sentence to the student that had been partitioned into four separately underlined

components. The student was to determine if any of the four components were in error, or if there was no error in the sentence at all. For English II, the focus was upon the correctness and effectiveness of expression. Each item contained one sentence followed by five different options for rephrasing it for standard written English. The instructions focused the student toward selection based upon word choice, sentence construction and punctuation.

Both mathematics subtests contained problem-solving type items. However, mathematics I contained problem solving for higher order computation, exponentials, algebra, linear equations, and geometry. Mathematics II contained items for interpreting graphs and set theory.

Initially, these tests were developed by Educational Testing Services for a college entrance examination for Florida. However, they were specifically chosen for use in the Decade Study because they were deemed to be demanding tests which would provide a useful evaluation of the academic achievement of high school juniors in Illinois. The characteristics of these six tests in terms of the number of items they contained, their Kr20 reliabilities, and their overall item difficulty (expressed as the Beta parameter from these parameters scaled by Logist V) are given in Table 3.

Insert Table 3 about here

As an indication of the difficulty level of these tests, representative items form a moderate level difficulty state assessment battery (Illinois State Assessment, 1980) were also included in the difficulty level analysis. A Logist V scaling of the decade subtests with the general state assessment items (Lord, 1980) showed that the overall difficulty of the general state assessment items was .18. By comparison, the difficulty level of the six academic tests, used in the present study, ranged from .85 to 2.00.

Social Context. The variables used to measure school context were school enrollment size, dropout rate, per pupil expenditure, student to teacher ratio. These data were obtained from school records.

Family Context. The variables used to measure family context were family size, level of mother's education, level of father's education, use of magazines in the home, and frequency of talking to parents about work in school. These data were gathered from the students through questionnaire items.

Student motivation was measured through items adapted from questionnaires regularly employed to assess attributions of success and failure, sense of competence, test anxiety, perceived value of education, expectations of success, and continuing motivation. The specific items employed are to be found in Table

4. These items had all been employed in similar statewide assessment projects and been subjected to extensive item analysis and tests of appropriateness of scaling (Fyans, 1983).

Insert Table 4 about here

Results

The purpose of this study was to determine the unique contribution of individual student motivation on academic outcomes. A comprehensive set of variables often considered to be antecedent to school achievement were formed into three clusters (family background, school characteristics, and student motivation). The goal, then was to determine the explanative power of these clusters, individually and collectively, in explaining the variance on each of the six dependent variables (Mathematics I, Mathematics II, English I, English II, Natural Science, and Social Science). Having established the essential composition of the variables, multiple regression analyses were conducted to estimate the proportion of achievement (test) variance accounted for by each of the three explanative clusters (school context, family context, and student motivation) individually and then as a full model (all taken at once). Commonalty analysis (Cooley & Lohnes, 1976; Mayeske, et al., 1969; Pedhazur, 1982) was then applied to the results to decompose the performance variance into that which was unique to

school context, unique to family context, unique to student motivation, and that which was attributable to shared variance. While there has been some criticism of commonality analysis for the potential of negative estimates of variance, this did not occur in the present endeavor.

The proportion of performance variance (R-square) for each academic achievement outcome by each explanative model are presented in Table 5. The R-squares presented in Table 5 reflect the proportion of achievement variance by each explanative model and by the full model (taking all models at once). Several findings presented in Table 5 are of special interest. First, achievement in mathematics and natural science appears to be predicted most by motivation profile. Second, the verbal skill areas of English and social sciences are most predicted by family background. The school context cluster offers relatively weak prediction for most academic subtests. The overall performance variance for the full model should also be noted. A relatively large percentage of resultant outcome variance appears to be explainable.

Insert Table 5 about here

Certain arithmetic algorithms, known as commonality analysis, can be used to partition the variance in multiple regression (Beatan, 1973; Cohen & Cohen, 1983; Kerlinger, 1973; Mayeske, et al., 1969; Pedhazur, 1982). Commonalty analysis approaches the

multiple regression from a hierarchical framework (Pedhazur, 1982). The unique contribution of a set of variables is essentially a squared semipartial correlation between the dependent variable and the independent variable of interest, after partialling out all other independent variables from it. Thus, as defined by Cooley and Lohnes, 1976), "The unique contribution of a domain of predictors to the multivariate prediction of a single criterion is defined as that part of the variance explained by the full model (using all predictor domains) that cannot be obtained without using the particular domain." (p. 220). The commonality deals with the performance variance attributable to the cross-correlation of all predictor domains. More specifically, it relates to the variance "Explained by the full model minus the sum of all the uniqueness." (Cooley & Lohnes, 1976, p. 220).

The results of the commonality analysis are given in Table 6. Focusing first on the variances unique to motivation, school and family, several results are evident from Table 6. Mathematics performance is predicted by the unique contribution of student motivation. The verbal skill areas of English and social sciences are explained most particularly by family context. For natural science achievement, a relative tie in explanative power occurs between student motivation and family context. The unique contribution of school context to the explanation of achievement in the three academic areas is self-

evidently small. The commonality amongst all the predictors accounts for more of the Mathematics II and Natural Science variance than any of the variance unique to school, family or motivation.

Insert Table 6 about here

One of the more interesting findings presented in Table 6 was that school context accounted for little of the variance across the academic achievement domains assessed. It may be noted that this finding essentially replicates what was found eleven years before (1970). In that 1970 panel of data the school context variables were also available for analysis for the 120 schools studied. Multiple regression of the school context variables for these schools for the 1970 data explained relatively meager amounts of performance variance. More specifically, in 1970 school context accounted for 1% of the variance for Mathematics I, 7% for Mathematics II, 2% for English I, 2% for English II, 6% for Natural Science, and 3% for Social Science.

The findings presented in Table 6 suggested a need to focus more intensively on the unique components of familial context and student motivation and perhaps to determine which particular family context and student motivation variables related most to achievement. To obtain these results, multiple regressions were conducted to obtain the standardized beta weights for each of the

family context and student motivation variates. The results for family context are presented first, in Table 7.

Insert Table 7 about here

In terms of family background, the results from Table 7, indicate that talking to parents about school was most positively predictive of achievement in English (I and II), Social Studies, and Natural Science. Education of Father is most predictive for skills in the quantitative domains of Mathematics I and II and Natural Science. Education of Mother is also positively predictive of Mathematics (I and II), social science and, to a lesser degree of English I and II.

Regression analyses were also reconducted to determine the relative explanatory contributions of each of the variables that composed the motivational cluster. The standardized beta weights stemming from these analyses are presented in Table 8.

Insert Table 8 about here

The single most positive motivational predictor (as can be seen from Table 8) was the student self-expectation of how well he or she would perform on a particular subtest. Attributing success at school to their ability or effort is also highly predictive of student achievement, whereas failure attributions

are not. The measures of continuing motivation (extra courses taken and extra books read) were not, in general, found to be especially important in explaining achievement. However, the patterns obtained in this regard are not without interest. Thus, it may be noted that while Extra Courses Taken is associated with achievement in Mathematics (I and II) and Natural Science, Extra Books Read was related to achievement in English (I and II).

Discussion

This research attempted to disentangle the variable effects of school context, family background, and student motivation on six major academic achievement areas. Overall, the findings suggest that the variables composing the School Context cluster was least predictive of achievement variance with the Student Motivation cluster being the most predictive.

Perhaps one of the most interesting findings was the amount of variance accounted for by student motivation. As a comparison, one might note that Walberg's studies of educational productivity (Uguroglu & Walberg, 1979; Walberg, Pascarella, Haertel, Junker, & Boulanger, 1982; Walberg & Uguroglu, 1980) estimate motivational contributions to achievement variance to be in the neighborhood of 11-20 percent. The greater relative contribution of motivation in this instance might be explained by the greater richness of motivational variables employed. Thus, Walberg's motivational variable was composed largely of items assessing students' self-concepts. The present study attempted to exploit more effectively the wide variety of motivational

constructs and variables available in the literature, employing basically newer variables that are well-established within the domain of motivation theory/research.

Not altogether surprising but still of interest is the finding that, overall, the Expectation variable was the most predictive across all achievement domains, although especially important in regard to mathematics (I and II). On the one hand, this may be interpreted simply as suggesting that students are knowledgeable or realistic about their ability. Without ruling out that interpretation of the results, one may note that this self-knowledge (if that is what it is) is not only associated with other motivational variables in this study but also is found to be a major determinant of motivation generally (see for example, Feather, 1982). Expectation for levels of performance is a major factor involved in determining choices and persistence on other behavioral patterns instrumental to learning and achievement. Achievement expectations are doubtlessly built up as a result of previous experience (cf. Steinkamp & Maehr, 1983), and reflect objectively assessed competence. However, an argument can be made that the subjective assessment of competence plays an important role in affecting achievement patterns (Nicholls, 1984; Roberts, Kleiber & Duda, 1981).

What is of some interest is a comparison of the beta weights (Table 8) for Expectation, Attributions (Success and Failure), and Sense of Competence. Whereas Expectation seems to be

relatively stronger in predicting Mathematics than the other areas, results in the case of Success Attribution tends to suggest a slight counter trend. The role of Sense of Competence was clearly minor. It is interesting--and somewhat predictable--that the two continuing motivation measures (Extra Courses and Extra Books Read) were differentially associated with achievement across the 6 achievement domains. Taking extra courses predicted achievement in Mathematics (I but not II) and Natural Science only minimally, outside reading predicted achievement in English (I and II). Somewhat surprisingly test anxiety and perceived value played at best a small role in predicting achievement. Doubtless this was in part due to the fact that it was highly correlated with other motivation predictor variables.

As already noted, the School Context cluster did not emerge as a significant contributor to school achievement. To the degree that it made any contribution at all, School Context was most highly associated with performance in Mathematics II. Considering the content covered in the mathematics II test (e.g., set theory, theory, and graphs) it is likely that this relationship reflects different course offerings in schools varying on the context variables) rather than any general and pervasive effects of context on achievement. That school context did not emerge as an important antecedent of school achievement is perhaps perplexing. However, a closer exploration of the variables that composed this cluster may shed light on the issue. First, it may be noted that none of the "organizational culture"

variables (see for example, Baden & Maehr, 1986; Maehr, 1987; Rosenholtz, 1985) that have been found to be important in school effectiveness are incorporated in this cluster (cf., however, Maehr & Fyans, 1987). Moreover, the variables that might have reflected the social problems confronted by the school (e.g., predominance of poor and minorities) were perhaps better reflected in the Family Context cluster. Yet, it is particularly important to note that we, as others before us (see for example, Walberg & Fowler, 1986), find that additional resources, while often suggested as a solution to educational problems, do not in and by themselves serve as a significant predictor of school achievement. Even a closer look at whether additional resources positively impacted schools with special problems, such as high minority enrollment, did not reveal any basis for suggesting that extra resources are the solution.

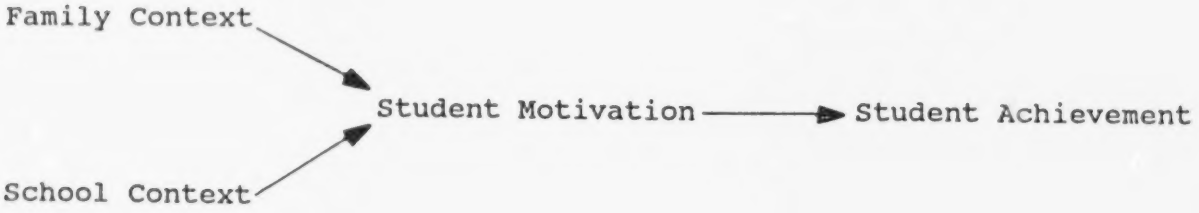
An emergence of the importance of the Family Context cluster is interesting and important in several respects. First, it is clear that the family is important to the school achievement of the child. That, of course, is not a new or surprising finding. However, the present results add an additional nuance or two to this well-established observation. First, it seems that the Family Cluster is important across all subject matter areas. However, when one considers more closely how the variables that composed this cluster relate separately to achievement, it may be noted that Talk to Parents about school emerges as virtually

equal in importance to parental education. Thus, it is probably not just the status of the home that is critical, not only as this is reflected in parental education and in the fact that the right materials (see Use of Magazines variable results, Table 5) are available or even used in the home, it is that parents talk to children that is important.

This set of findings perhaps serves to suggest what is important about homes so far as education is concerned--it is a suggestion that goes beyond the simplistic assertion of the importance of social class. It is not, strictly speaking, parental status but parental behavior that is important to student achievement. It is when parents interact with children about school that the home is likely to have a positive effect on achievement. Whether this variable is primarily an index of what is valued by the family (see,Majoribanks, 1987) or an example of a technique that can be practiced to enhance children's achievement cannot be sorted out here. It is probably both. Parents show that they value education when they talk to children about school and talking to school probably helps to convey expectations to children. But such talk probably also serves to complement school learning and further achievement directly. So, it seems that one can rightly encourage parents to interact with children about school as a positive intervention which has effects that transcend social status.

But we return, finally, to the major finding of this study, one that sets the basis for further reports on this program of

research (Maehr & Fyans, 1987; Fyans & Maehr, 1987). That finding is that motivation plays a critical role in determining school achievement. While this has been said before, it has most often been said on the basis of informal observations and seldom quantified in the way it has been in this study. We feel strongly that this point is worth stressing, especially in this initial report on a massive study of motivation and school achievement. How motivation affects achievement patterns and whether it is more important at different ages and in regard to different subject matter areas are questions that will be explored in subsequent reports. Additionally, there is the question of the nature and degree of dependency of motivation on Family Context---and also School Context. The present study, of course, concentrated on separable effects. A more sophisticated approach might consider a test of the model suggested below:



However, we will leave the consideration of such more sophisticated models to future reports. For now we are content simply to make the point that the motivational realm is important. The motivation of a student relates directly to

whether the student will deliver the extra effort or persist that amount of time to complete a task well or to obtain more knowledge in a subject area. Plans for school improvement often focus on curriculum offerings or course requirements. Although student motivation is often discussed by educators, it is less often a part of school improvement efforts. The results of this research illustrates the vital and critical role played by motivation in relating to resultant school achievement. The best intentions of parties interested in improving student and school performance on outcome measures will go awry without significant consideration of the student's motivation and perceived meaningfulness of education.

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Table 1

Independent Variables (And Their Clusters) Considered In Reference to Student Achievement

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School Context Variables

- Enrollment
- Dropout Rate
- Student to Teacher Ratio
- Per Pupil Expenditure

Family Context Variables

- Family size
- Mothers education
- Fathers education
- Use of magazines in home
- Talking to parents about school

Motivation Variables

- Attribution of success
- Attribution of failure
- Level of competence
- Test anxiety
- Perceived value of education
- Expectation of Success
- Continuing/Intrinsic Motivation

Table 2

Average Characteristics of School

	1970	1981
Percent dropout rate	5%	4%
Enrollment	433	435.3
Student to Teacher ratio	18.4	14.8
Per pupil expenditure (unadjusted for inflation)	$1026.54	$2157.90

Table 3

Characteristics of Achievement Tests

Test	Number of Items	Kr20	Beta Difficulty (Estimated by Logist)
Natural Science	23	.66	1.35
Social Science	30	.75	1.36
English I	35	.78	1.18
English II	30	.80	.85
Mathematics I	36	.81	2.00
Mathematics II	24	.71	1.51

Table 4

Motivation Questions Employed

Success Attributions

When you do well on a test at school it is because

a) you are smart

b) you studied very hard

c) you were lucky

d) the test was easy

Failure Attribution

When you do poorly on a test at school it is because

a) you are not very smart

b) you did not study enough

c) you were unlucky

d) the test was hard

Sense of Competence

How well do you think you read?

a) I read worse than most student my age

b) I read as well as most students my age that I know

c) I read better than most student my age that I know

Test Anxiety

Do you feel relaxed when the teacher says that he/she is going to ask you questions to find out how much you know?

a) Yes

b) No

Table 4 (Continued)

Do you like tests in school?

a) Yes

b) No

Do you feel relaxed before you take a test?

a) Yes

b) No

Do you feel relaxed while you are taking a test?

a) Yes

b) No

When the teacher says that he/she is going to give the class a test, do you usually feel that you will do good work?

a) Yes

b) No

When the teacher says that he/she is going to give the class a test, do you feel relaxed and comfortable?

a) Yes

b) No

While you are taking a test, do you usually think you are doing good work?

a) Yes

b) No

Table 4 (Continued)

Perceived Values of Education

Circle the letter which shows how important it is for you to do well on this mathematics test you just completed.

a) Not important at all

b) Important

c) Very Important

Expectation of Success

Out of the 60 items in the Mathematics Test, how many do you think you answered correctly?

a) 1-15

b) 16-30

c) 31-45

d) 46-60

Continuing Motivation (2 questions)

How many courses in mathematics have you had in high school?

a) None

b) One

c) Two

d) Three

e) Four or More

Table 4 (Continued)

Continuing Motivation

In addition to books you use for schol work, how often do you read books?

a) Never or hardly at all

b) Once or twice a month

c) Once or twice a week

d) Just about every day

Table 5

Performance Variance Accounted for by Individual Motivation, Family Context and School Context

Model	Math I	Math II	Eng. I	Eng. II	Nat. Sci.	Soc. Sci.
School Context	8%	11%	4%	6%	4%	5%
Family Context	17%	20%	20%	24%	22%	27%
Motivation	35%	34%	13%	17%	29%	21%
Full Model	45%	48%	34%	44%	43%	41%

Table 6

Commonality Analysis of Performance Variance by Each Model

Model	Math I	Math II	Eng. I	Eng. II	Nat. Sci.	Soc. Sci.
Unique to school context	1%	4%	7%	10%	6%	7%
Unique to family context	7%	8%	15%	17%	10%	15%
Unique to student motivation	20%	13%	4%	7%	11%	4%
Commonality	17%	23%	4%	10%	16%	15%

Table 7

Standardized Beta Weights Regressing Family Context on Academic Performance

Family Context Variable	Academic Domain					
	Math I	Math II	Eng. I	Eng. II	Nat. Sci.	Soc. Sci.
Family Size	.12	.13	.13	.13	.05	.12
Mothers Education	.20	.21	.15	.14	.08	.22
Fathers Education	.25	.21	.10	.08	.22	.14
Use of Magazines in Home	.02	.10	.08	.23	.14	.09
Talk to Parent about school	.09	.15	.33	.27	.26	.32

Table 8

Standardized Beta Weights Regressing Student Motivation Variables On Academic Performance

Student Context Variable	Academic Domain					
	Math I	Math II	Eng. I	Eng. II	Nat. Sci.	Soc. Sci.
Sense of Competence	.04	.01	.19	.09	.01	.06
Expectation	.52	.51	.17	.20	.22	.24
Success Attribution	.12	.17	.14	.18	.43	.29
Failure Attribution	-.12	.05	.07	.17	.04	.04
Perceived Value	-.16	-.09	-.02	.01	-.06	.01
Test Anxiety	-.09	-.09	-.03	-.11	-.09	.02
Continuing Motivation: Courses	.17	.08	.06	.07	.17	.05
Continuing Motivation: Books	.05	-.13	-.10	-.13	.01	-.06